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Caltrans Division of Research, Innovation and System Information

Research Results

# Upgrading the Video Vehicle Detector Verification System

***Enhancements improve tool for testing the accuracy of vehicle detection equipment***

Transportation Safety and Mobility

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**Project Title:**
Upgrade the Video Vehicle Detector Verification System (V2DVS)

**Task Number:** 1726

**Start Date:** June 1, 2008

**Completion Date:** June 30, 2013

**Product Category:** Improved equipment and decision-support tool to evaluate new commercial products to determine if they meet Caltrans' needs

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## WHAT WAS THE NEED?

The accurate detection of the presence, speed, and length of vehicles on roadways is critical for effective roadway congestion management and safety. Caltrans uses vehicle detection sensors to measure traffic volume and control signalized intersections and ramp meters. Real-time detection is also necessary for automated driver information systems. Typically, in-pavement inductive loops are used, but newly developed out-of-pavement and wireless in-pavement detection systems can be quicker to install and cheaper to maintain.

Each detection method has advantages and limitations and can yield different results, making a particular system appropriate for some applications but inappropriate for others. In some traffic situations, the sensors occasionally fail to detect, falsely detect, or multiple detect individual vehicles. These errors tend to cancel each other when the data is aggregated into bins, as is common practice, but much more information can be gleaned from individual vehicle records, both in real time and in post-processing. Data for individual vehicles is also needed to know how these detectors perform in different situations to optimally specify equipment for particular detection requirements and environments.

*V2DVS equipment cabinets with pole-mounted vehicle detectors and bridge-mounted cameras and vehicle detectors*

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# Upgrading the Video Vehicle Detector Verification System

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Initially, compiling individual detection data required manually comparing each event record to video ground-truth, which is a labor-intensive process that is practically impossible for large datasets. Caltrans had developed the Video Vehicle Detector Verification System (V2DVS) to address this issue, however, the initial release measured only count accuracy, and not speed or occupancy.

## WHAT WAS OUR GOAL?

The goal was to improve the V2DVS by adding the capability to quantitatively measure and compare detector speed and occupancy accuracy to help traffic engineers choose the appropriate equipment for a given application.

## WHAT DID WE DO?

Caltrans, in partnership with the California Polytechnic State University Electrical and Computer Engineering Department, updated the V2DVS to capture more information. The original system that was installed on I-405 in the California Traffic Management Laboratory (CTMLabs) Detector Testbed was modified by installing new motherboards, power supplies, video cards, and disk drives in the six field machines—one for each lane of the test site. The server and user interface software were rewritten to accommodate the new functionality. The researchers used the upgraded V2DVS to test selected out-of-pavement and wireless in-pavement detection systems, along with duplex inductive loop detectors, located in the Detector Testbed on I-405 in Irvine. Data collection was performed over a three-hour period across the six lanes comprising heavily and moderately congested, as well as free flow, conditions. Over 22,000 individual vehicle events were captured. The researchers also documented how to set up the V2DVS for detector testing.

*V2DVS equipment cabinets: Detection equipment (left); field PCs, one for each lane (center); server (right)*

## WHAT WAS THE OUTCOME?

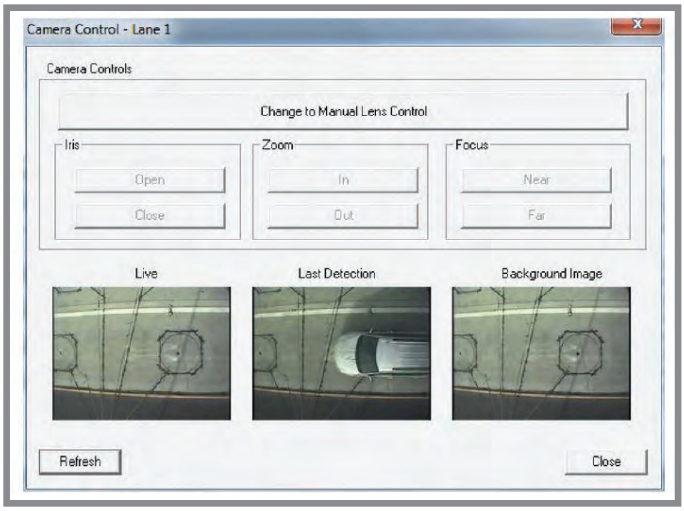
The V2DVS can quantitatively compare the accuracy of count, speed, and occupancy data generated by detectors with outputs compatible with standard 170 and 2070 controllers. It also offers improved automated comparative analysis based on the new adaptive weighted consensus filter. Preliminary analysis suggests that the inductive loops outperform the other detectors by all metrics, which is not surprising, because the accuracy of the detection system is directly proportional to the sensor's proximity to and alignment with the traffic being measured. The results help assess the tradeoff between accuracy and ease of installation and maintenance.

## WHAT IS THE BENEFIT?

Inductive loop detectors are more accurate but also more expensive to install and maintain. The enhanced V2DVS provides traffic engineers additional needed information to assess whether the performance characteristics of a less expensive detection system is an appropriate solution for a given application. Being able to evaluate the accuracy of different equipment leads to the judicious implementation of detection systems in terms of value and effectiveness.

## LEARN MORE

To view the complete report:
*www.dot.ca.gov/research/researchreports/reports/2012/2012-03_task_1726-tsm.pdf*




*Remote Camera Control window*